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A Discussion of Technological Considerations

EXECUTIVE SUMMARY REPORT

to GOVERNOR MILTON J. SHAPP

by the GOVERNOR'S SCIENCE ADVISORY COMMITTEE

Commonwealth of Pennsylvania
Milton J. Shapp, Governor

Department of Commerce
John J. O'Connor, Secretary

March 1976

PROLOGUE

The Panel

In September 1973, the Governor's Science Advisory Committee (GSAC) presented to Governor Milton J. Shapp a report, *Energy for Pennsylvania - An Action Plan.* This report identified "the urgency and importance to Pennsylvania of proper development of nuclear power and of the three C's — Conservation of energy, Conversion to coal (in the 70's), and Conversion of coal to sulfur-free gas and oil (for the 80's)". Later, in accord with the Governor's request, GSAC former a *Panel on Criteria for Power Plant Siting*.

The Past

The total electrical generating capacity in Pennsylvania doubled, from 10,000 to 20,000 megawatts between 1962 and 1972, and is expected to increase to about 32,000 MW by the early 1980's.

The Present

Recently, major changes have affected the availability and cost of energy. Faced with rising costs and recession, utilities have stretched out or cancelled plans for construction of power plants for the 1980's. Uncertainty as to the course of power plant development is apparent.

The Uncertain Future

Thus, Pennsylvania's use of electricity in the 1980's and 1990's may increase at a lower rate than before (say, 3 to 3.5%/year) with energy conservation and high costs, or at a higher rate (perhaps 7 to 9%/year) due to a shortage of natural gas and oil. If such estimates represent the lower and upper limits of what may happen, between 1976 and 2000, we may install new plants with combined capacities of 30,000 to 100,000 MW or more, greater than all built here before.

How Many Sites?

How many plants will be needed, of what size, and where? With plants of 1000 to 3000 MW, twenty to fifty new sites are needed. With energy parks, clusters of 10,000 to 20,000 MW, the number would be much smaller. Use of "mini plants" of 100 MW or smaller near the user, burning coal and wastes, could add many small sites.

Limits of Knowledge

Such choices require full knowledge of impacts of alternate technologies on the Commonwealth's water, land and air, and on health and the economy. Full understanding is a tall order and must be in reference to specific sites. Further, socio-economic issues arise which involve considerations other than technological.

Limited Purpose of Study

Mindful of this and its own limited resources, the Panel wishes to emphasize the limited purpose of this report, namely,
TO INITIATE EXPLORATION OF BASIC TECHNOLOGICAL CONSIDERATIONS RELATED TO POWER PLANT SITING, AND TO IDENTIFY SOME ISSUES WHICH THEY RAISE.

This report is based on the Panel's consideration of briefings from the Department of Environmental Resources, published material on nuclear power, emission controls, energy parks, mini plants and land use, and especially on reviews and analyses (see the full technical report) by four members of the Panel.

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CONCLUSIONS

AND

RECOMMENDATIONS

OVERVIEW AND CONCLUSIONS

EXPANSION NEEDS

Long range projections of electrical energy use at this juncture are highly uncertain and debatable. However, the Panel believes it likely that between 30,000 and 100,000 MW of new electrical generating capacity will be installed in Pennsylvania by the year 2000, adding to the 32,000 MW in place in 1980. The land required for these new installations may total perhaps 70 to 300 square miles.

The most probable fuels will be coal and nuclear power, most likely with a preponderance of coal. Wood and municipal wastes may fuel mini plants; liquid fuel and low BTU gas from coal may be used after 1990. Some new hydroelectric plants as secondary generating stations, acting as two-reservoir pumped storage systems, could help meet peak power demands, using stored energy produced by coal-fired or nuclear plants during off-peak periods.

SITE REQUIREMENTS

Key factors in the search for sites are land, water and transportation, the protection of health and safety and of environmental, aesthetic and community values, and proximity to fuel supply and markets.

The most exacting requirement is the assured availability (even during prolonged droughts) of large volumes of water for steam generation and cooling without pollution or diminution of Pennsylvania's streams. Perhaps 15 to 20 sites on Pennsylvania's streams can accommodate (with cooling towers) plants as large as 1000 MW; use of artificial ponds and lakes to assure adequate flows appears certain.

Sites should not encroach on critical land uses (such as farms or historic sites); they must provide for waste disposal, transporation, security, and public health and safety. Sufficient land for disposal of huge tonnages of ash and sludge may be a major problem for most coal-fired plants. It may be that small plants (for example, 100 MW or smaller) can be sited in some more developed as well as lesser developed areas, and on many of Pennsylvania's streams.

The degree to which air pollution remains a problem for coal-fired plants will depend on the success in development of technology to burn coal cleanly. Meterological conditions do not provide major advantages for one section of Pennsylvania over another. It is necessary to proceed with great care with, and preferably to avoid, sites in valleys prone to inversions, and air basins carrying a high pollution burden or directly upwind from nearby population centers.

Nuclear sites must facilitate safe transportation and temporary storage of fuel and radioactive wastes, security guarantees against saboteurs and theft, and protection against adverse effects of natural disasters (flood and earthquakes) or accidents.

RATIONALE FOR SITE SELECTION

It appears to the Panel that the above technological considerations suggest the following rationale concerning power plant siting in Pennsylvania.

First, it is ESSENTIAL that

- Power plants must not be sited where effective protection cannot be provided against natural hazards, such as floods, slides, earthquakes, or man-made hazards, such as air approach zones or mine subsidence.
- Coal-fired plants must not be sited where their emissions can present health hazards to population centers; furthermore, care must be taken in siting coal-fired plants in valleys prone to inversions or in air basins carrying a high pollution burden.
- Nuclear plants must not be sited where effective protection of population centers against radioactive materials (including subsequent decontamination), cannot be provided in case of, despite multiple redundant safeguards, an accidental release.

Second, we believe that AS A PRACTICAL MATTER

- Sites for large power plants, requiring large tracts of land and large quantities of water are virtually certain to be located in UNDEVELOPED OR LESSER DEVELOPED REGIONS IN PENNSYLVANIA'S WATERSHEDS.
- Large coal-powered generating stations will frequently be located at such sites in Pennsylvania's bituminous coal and anthracite fields; otherwise, at sites with assured transportation for coal.

Third, TRADE-OFFS EXIST FOR A NUMBER OF DESIRABLE TECHNICAL GOALS whose achievement is highly site specific. Factors specific to the proposed plant will determine which trade-off will make which site most acceptable.

These goals include the need

- to minimize undesirable impacts on critical land areas, communities, and downstream water users.
- to maximize energy conservation
  - -- through use of waste heat in agricultural or other applications
  - -- through trade-offs between energy consumed in transportation of coal and water vs. transmission line losses
- to minimize the cost of electricity to the consumer
- to maximize the contributions to the local community and to the recreational facilities of the Commonwealth

Fourth, SMALL POWER PLANTS, BURNING COAL AND WASTES OR WOOD, appear to offer special advantages where sites suitable for them (but not for larger plants) exist on Pennsylvania's streams, in Pennsylvania's communities, or in air basins highly sensitive to additional air pollution. Their use may depend on the trade-offs presented by energy conservation and potential higher electricity rates.

KEY ISSUES

The Panel recognizes that many policy-related uncertainties have arisen relevant to power plant siting which illustrate the complex interaction between social, environmental, political, and economic concerns and basic technological considerations such as those identified in this initial exploratory study.

Among these key issues are uncertainties in

- The Commonwealth's Future Electricity Generating Needs in the face of limited resources, environmental controls, and economic uncertainty ahead
- Federal Policies including
  - -- the proposed 1976 Clean Air Act Amendments
  - -- the ultimate requirements of the National Clean Streams Act
  - -- the result of the national debate on nuclear plants and containment and storage of radioactive wastes, and national studies of concentrated siting of nuclear power plants
  - -- National Energy Policy
  - -- Federal land use legislation
- The Issues of Local Incentives and the Protection and Enhancement of Local Values and the impacts of these on the acceptability of public, private and commercial developments by local communities
- The Commonwealth's Land and Water Management Policies relevant to all future public, private and commercial developments in the State
- The Trade-Offs Which Different Types and Sizes of Power Plants and Sites Offer in Pennsylvania as impacted by the issues above
- The Adequacy of Existing State Policy Guidelines and Agency Structures to respond to the intra- and interstate concerns on energy facility siting

RECOMMENDATIONS

I. COMMONWEALTH DEVELOPMENT POLICY: AN OVERRIDING NEED

TARGET: Orderly siting and installation of needed energy facilities (as well as other public and private developments) in a manner consonant with prudent land and water use, protection of the environment, public health and safety, and promotion of the economy and general welfare.

RECOMMENDATION: COMMONWEALTH SITING LEGISLATION

The executive and legislative branches should address the issue of land use in public and private developments, particularly the siting of energy facilities. Legislative and administrative actions should be taken providing policy guidelines and administrative mechanisms to assure that Commonwealth energy needs on the one hand, and its environmental, land, water, health, safety, economic, and community goals on the other, are met in a timely, balanced, and economical manner.

ACTION:

The Governor should recommend that the legislature review future energy (and other) development needs in the Commonwealth; he should urge legislation establishing policy guidelines and administrative mechanisms regulating land use development and energy facility siting in the Commonwealth.

To this end the Governor should direct the Office of State Planning and Development, the State Planning Board, the Public Utility Commission, the Attorney General, the Energy Council, the Departments of Agriculture, Commerce, Community Affairs, Environmental Resources, Health, Transportation, and other appropriate agencies to conduct, in a coordinated fashion, the necessary studies to identify the key issues, options, their significant costs and benefits, and the priorities which should be considered in such legislation.

(Specific issues and questions are suggested on pp. B1 to B6, inclusive).

TARGET: Vigilance against possible hazards - recognized or currently unknown - to health and safety arising from the operations of, and emissions from coal-fired, nuclear and other energy facilities in Pennsylvania.

RECOMMENDATIONS: EFFECTIVE CONTROL AND VIGILANCE

- The Commonwealth should continue to provide knowledgeable and even-handed administration regulating the siting and operations of, and control of emissions from, energy facilities in Pennsylvania.
- The Commonwealth must maintain a close overview of the utilities environmental monitoring systems (chemical and biological) and must operate a supplementary environmental monitoring system of its own. The purpose is to assure full, reliable measurement of the effects of emissions from fossil-fueled and nuclear electrical generating plants (and other energy facilities) on the environment, on organisms in man's food chain, and on humans. The Commonwealth "watchdog" program must provide constant critical analysis of all such data to spot at an early date any source of immediate or long-term risk and to measure the potential for acute or chronic effects on health. Periodic reports to the Governor and legislature on the results of such analyses should be required, with recommendations when appropriate, of guidelines for prudent adjustments in energy facility operations.

ACTION:

The Governor's Energy Council, working most closely with the Departments of Agriculture, Commerce, Community Affairs, Environmental Resources and Health, the Public Utilities Commission, the Governor's Advisory Committee on Atomic Energy Development and Radiation Control, the Attorney General's Office and other appropriate agencies, should review the present relevant Commonwealth policies and programs and recommend administrative and legislative actions to assure that effective Commonwealth "watchdog operation" is employed.

APPENDIX A

SUMMARY OF FINDINGS

POWER PLANT SITING

IN PENNSYLVANIA

1976 — 2000

I. PROJECTIONS OF POSSIBLE SITING NEEDS: 1976 — 2000

Past Trends: Pennsylvania's Electricity Generation Plants

- Since 1950, statewide capacity nearly doubled each decade and is expected to total 32,000 MW in the early 1980's.
- Typical new plant size increased from 100 to 1000 MW between 1950 - 1975.
- New trend to coal and nuclear is replacing trend to oil in the 60's.

Likely Growth Limits (1976 — 2000)

- Low growth estimate, 3.0 to 3.5%/year, requiring an additional 25,000 to 30,000 MW by year 2000.
- High growth estimate, 7%/year or more, requiring additional 100,000 MW or more by year 2000.

Plant Size

- Nuclear plants much smaller than 800 MW are not economical and probably won't be built.
- Coal-fired plants of 1000 to 2500 MW are common in the U.S. today.
- "Mini Plants" of 100 MW or less burning coal and wastes are suggested by some.
- Energy Parks, clusters of coal or nuclear units totaling 10,000 to 20,000 MW are under study by federal agencies and some utilities.

Number of Sites Required (1976 — 2000)

- With current practice, 20 to 50 plants of 1000 to 2000 MW are needed at scattered sites.
- Energy Parks of 10,000 to 20,000 MW would reduce this number.
- Significant use of 100 MW mini plants would utilize many sites near users.

II. SITING CRITERIA: GENERAL GUIDELINES

POWER PLANTS USE WATER, LAND, AND FUEL, AND PRODUCE WASTES AND HEAT. POLLUTION OR ACCIDENTS CAN OFFER HAZARDS TO ENVIRONMENT, HEALTH, SAFETY, AND PROPERTY.

SITING CRITERIA MUST AVOID

- Natural hazards (floods, earthquakes, slides)
- Man-made hazards (air approach zones, mine subsidence areas, etc.)

SITING CRITERIA MUST SEEK TO MINIMIZE

- Impacts on water, land, communities
- Encroachments on areas of unique value

  (farms, forests, historic, recreational, ecological)
- Hazards to health and environment
- Energy and transportation demands
- Costs to electrical consumers

III. SITING CRITERIA: SPECIFIC TECHNICAL CONSIDERATIONS

A. WATER — A DEMANDING NEED TO DISPOSE OF WASTE HEAT

PENNSYLVANIA RIVERS

- USING ONCE THROUGH COOLING offer many sites for small plants (100 MW) but few if any (except possibly on the Delaware) for large (1000 MW) unless there is flow augmentation.

- USING WET COOLING TOWERS offer 15-20 sites for 2000 MW units but few if any for larger plants unless there is flow augmentation.

ARTIFICIAL LAKES (with make-up water from streams during flood periods) assuring flow for once-through cooling or towers.

- Each, depending on size, could provide water for one or a number of large plants, dispersed or in clusters.

- Could be dedicated to this use with water management regulations assuring protection to public streams and health.

- May also offer recreational opportunities which could be exploited.

DRY COOLING TOWERS

- Offer an alternate (albeit expensive) means for heat dissipation where assured water flows are low.

B. LAND — A VALUABLE RESOURCE IN TIGHT SUPPLY

- Area needs for 1000 MW plants range from 1 to 4 square miles depending on cooling and refuse disposal needs; energy parks need 10 to 60 square miles.

- Large sites in populated areas face limited availability and high prices for land, higher existing pollution, with an attendant higher population risk.

- Sites for mini plants may be possible in densely populated areas.

- Coal-burning plants require on-site storage for coal and wastes, with areas, not necessarily on-site, for permanent waste disposal.

- Nuclear plants require temporary storage of spent fuel rods with radioactive fission products and a buffer area around the plant.

C. AIR MOVEMENT -- GENERALLY A LOCAL CONSIDERATION

AIR POLLUTION AND WEATHER

- Inversions are more likely in valleys and slightly less likely in eastern and northwestern Pennsylvania.

- Sulfur-oxides from coal-fired plants can be held to safe levels by emission controls, but controls of NOx and trace polycyclics and metals are not fully demonstrated. Tall stacks could lower health hazards near the site but may introduce risks from sulfate particulates at greater distances downwind.

- Large coal-fired power plants should not be sited in air basins with high pollution levels; small plants generally present smaller hazards.

- Large energy parks discharge heat and moisture and, as a city, may increase cloud formation and precipitation in a corridor up to 30 miles downwind from the site. The increase may be enough to be unacceptable in some cases, though additional rainfall may be beneficial in others. Some control of such effects through the choice of spacing of cooling towers and by use of waste heat should be possible.

- Continued improvement in power plant siting guidelines assuring effective economical safeguards to the environment and health will result from continued research on the fate and effects of emissions from electrical generating plants.

D. TRANSPORTATION — A MAJOR LOGISTIC PROBLEM

FUELS ARE NEEDED

- 100 MW mini plants could burn annually over 300,000 tons of coal, a 1000 MW plant 2,500,000 tons, and a 20,000 MW energy park 50,000,000 tons. Transport options are barges, belt conveyers, unit trains, or slurry pipelines.

- A 1000 MW nuclear power plant requires 30 tons/year of fuel. New fuel rods do not present a radiation hazard.

WASTES ARE PRODUCED

- A 100 MW coal plant may produce over 120,000 tons of ash and sludge annually, a 1000 MW coal plant 1 million tons, and a 20,000 MW coal-fired park 20 million tons of wastes. On-site disposal or barge or slurry pipelines are the options.

- A 1000 MW nuclear plant yields 30 tons/year of spent fuel containing highly radioactive fission products. Shipments to a reprocessing plant are made in thick steel-lead-steel casks, which function as effective radioactive shields. Larger, stronger casks are under design to minimize shipments. Security against theft and sabotage is required.

E. TRANSMISSION LINES — NECESSARY CONDUITS

- Siting criteria should minimize environmental, land, and aesthetic impacts while meeting reliability standards at acceptable costs. Multiple utility corridors may be economic and feasible.

- Overhead high voltage alternating or direct current systems are options now; underground lines and/or superconducting or cryogenic systems may be options later.

- Transmission line land requirements and costs for different plants are site specific; local mini plants in some instances offer low transmission losses.

F. HEALTH AND ENVIRONMENTAL HAZARDS -- REQUIRING STRICT CONTROLS AND VIGILANCE

HAZARDS FROM NORMAL OPERATIONS

- Pollutants from coal-fired plants at sufficiently high concentrations give rise to health effects which may vary with the age and susceptibility of the individual. Reduction of the effects on public health produced by emissions from coal-fired plants depends first on the use of available emission controls and safeguards, and ultimately on improvement of these and on better understanding of the fate and effects of such pollutants in the atmosphere.

- The United States Environmental Protection Agency estimates in the year 2000 per capita radiation dose of 0.17 millirems annually from reactors versus 88 millirems from medical radiation exposures and 130 millirems from normal background radiation.

- Health effects of the small amounts of radioactive materials released in normal operations of nuclear plants are below measurement. However, close analysis and evaluation needs to be made of the effects of radioactive materials released over a long time -- i.e., 50-200 years. Federal regulations require monitoring of radioactive releases and of buildup of radioactivity in algae, sediments, and soils.

- Heat released into water may greatly alter the aquatic life and uses of surface waters for other purposes unless the plant design eliminates all but very small temperature rises beyond the mixing zone. Alternatively, such heat may in some instances be used to provide an environment beneficial to certain aquatic life, and may be exploited as in aquatic farming.

HAZARDS FROM ACCIDENTS

- The most serious accidents associated with coal-fired generation of electricity occur in the mining and transportation of coal. The risks can be minimized by safeguards and by reducing the need for coal transport, by mine-mouth siting of power plants, for example.

- There is no way a nuclear plant can produce an atomic explosion. The most serious accident conceivable is a core meltdown, with possible release of radioactive materials. This requires first, a break in the cooling water system for the nuclear core plus a failure in the emergency flooding system. Escape of radioactive material then requires penetration of the thick steel pressure vessel and of the surrounding massive reinforced concrete structure plus failure of additional safeguards to remove heat and radioactivity.

  The danger to life and health is inherent in possible exposure to radiation from the radioactive materials which may escape, and its extent is dependent on how well they are localized, contained, and decontaminated. Thus the level of potential hazard to the public is dependent on the effectiveness of multiple redundant engineering safety features as well as on the degree of isolation from population centers.

- Sixty scientists in a three-year study concluded that in the United States in 1980, one will have one chance in 5 billion per year of being killed by a nuclear accident. This corresponds to one fataility and ten injuries every 10 years among 15 million people within 25 miles of 100 reactors. The chance of 100 or more fatalities in one accident is 1 in 100,000 years, and for 10 or more fatalities is 1 in 30,000 years.

- Long term storage of nuclear wastes is most unlikely in Pennsylvania. One proposal to meet the hazard of radioactive waste is to convert it to a ceramic solid with permanent storage in an isolated heavily shielded vault, possibly in an underground rock salt formation. The adequacy of safeguards in the storage of nuclear wastes is the subject of major Federal research and is of wide interest nationally.

RISK LEVEL, ASSESSMENT AND REDUCTION

- The assessment and reduction of hazards from the use of fossil fuels requires extensive and continued study.

  --Deaths from the mining and transportation of coal happen and the risks are known. Operations and safety criteria must be continually studied and improved and applied. The recovery of methane from coal fields prior to mining deserves study as a means to reduce mining hazards.

  --The risks from pollutants from burning fossil fuels must also be the subject of constant investigation. Intensive research on the presence, chemistry, transport, and health effects of sulfur oxides, sulfates, particulates, nitrogen oxides, trace metals, and aromatics from power plants is required. Engineering technologies designed to guard the public against the potential health hazards must be constantly improved and applied, with extensive monitoring of the effects of control strategies.

- Estimates of hazards from nuclear risks are based on extensive studies, and efforts to assess more accurately the risk and to develop additional safeguards are continuing. The significance of such estimates is a subject of national scrutiny.

  --Leakage from normal power plant operations and accidents, such as the one at Browns' Ferry, happen. Design criteria and safeguards must be continually studied and improved, and applied. Much more emphasis must be placed on locating sinks and areas of concentrations of radioactive chemicals so that they do not unknowingly build up.

  --The assessment of risks and safeguards in the handling and storage of nuclear wastes must be continued and given high priority, support and review.

APPENDIX B

ISSUES AND
SPECIFIC QUESTIONS
RELEVANT
TO A
COMMONWEALTH
DEVELOPMENT POLICY

ISSUES AND SPECIFIC QUESTIONS

The following issues and questions are among those which must be addressed in establishing a Commonwealth development policy.

I. WHAT ARE THE COMMONWEALTH'S LONG RANGE ELECTRICITY GENERATING NEEDS?

THERE IS A NEED FOR INITIAL AND ON-GOING ANALYSES OF THE EFFECTS OF

-- Higher rates on luxury and other uses

-- Rate structures on peak power loads and electrical energy demands

-- Conservation and higher efficiency in power generation and use

-- Environmental control requirements

-- Uncertain availability and high price of oil and natural gas

-- Worldwide and national economic trends

-- Population trends and mix

-- Growth of Pennsylvania industry and agriculture

-- Availability and costs of nuclear fuels

-- Use of solar energy

-- Developments of coal liquification and gasification and more efficient direct coal combustion technology

-- Development of efficient heat pumps

-- A possible electrification of rail and auto transportation systems

-- Possible wide use of telecommunication technology

-- Possible trend toward multiple unit housing and inner city instead of suburban development

-- Possible trend to replace machines with human labor and other changes in life style

II. HOW WILL FEDERAL POLICIES IMPACT ON ENERGY FACILITY SITING IN PENNSYLVANIA?

- WHAT WILL BE THE PRECISE TERMS OF THE CLEAN AIR ACT AMENDMENTS?

  -- Will sites for large coal-fired plants be limited to few and far between, and practically be limited to 800 MW and smaller?

  -- How will Pennsylvania's ability to use coal to meet its electricity needs be affected? Energy conservation? Cost of electricity?

- WHAT WILL BE THE REQUIREMENTS OF THE CLEAN STREAMS ACT?

  -- Will thermal pollution limits be uniformly applied in all of Pennsylvania's streams regardless of specific needs and use?

  -- How will thermal pollution limits affect the need for dams and artificial lakes, and cooling towers? How will this impact on Pennsylvania's water systems? on land use? on siting options?

  -- What will be the impact on electricity costs?

- WHAT WILL BE THE RESULT OF THE CURRENT NATIONAL SCRUTINY OF NUCLEAR POWER PLANT OPERATIONS?

  -- Will thorough assessment of nuclear hazards and safeguards result in safer operations and public acceptance or in wide public fears and a slowdown in new nuclear installations?

  -- Will clusters of nuclear plants of some intermediate size possess sufficient advantages in added security and safety (without the disadvantages of very large clusters) to recommend their use?

  -- How will the security and safety considerations affect nuclear power plant siting in Pennsylvania?

- WILL WE HAVE A NATIONAL ENERGY POLICY AND WHAT WILL IT BE?

  -- How will it affect the availability and costs of natural gas and oil, of coal and nuclear energy, of solar power, of synthetic liquid fuels and gas from coal?

  -- How will it affect energy conservation and energy demands?

  -- How will it affect the demand for electricity in Pennsylvania?

- WILL WE HAVE FEDERAL LAND USE LEGISLATION?

  -- How will it impact energy facility siting and other public and private developments in Pennsylvania?

III. HOW CAN THE ENHANCEMENT OF LOCAL VALUES BE ASSURED IN THE EVENT OF PUBLIC, PRIVATE, AND COMMERCIAL DEVELOPMENTS?

- HOW CAN LOCAL VALUES BE ENHANCED?

-- What roles should Federal, State and local governments play in regulating energy facility siting and other public and private developments?

-- What roles should Federal, State and local governments and private industry play in moderating the burdens of schools, fire and police protection, housing, transportation, health, recreation, etc., placed on local governments by the temporary influx of workers and their families during the construction of a large energy (or other) facility?

-- What are the pros and cons of revising the State tax laws affecting utilities to provide affected local communities a larger share of the real estate tax?

-- Can construction workers for large energy facilities be housed with less disruption in established cities within commuting distance (20-40 miles from the site)?

-- Would the possibility of using reclaimed lands for energy facilities (and other developments) represent a multiple benefit to the community and the State?

-- What will be the impact of the trend to an older population in the 80's and 90's on local needs - housing, schools, jobs, revenue - and how will this affect the acceptability of energy facility developments?

-- Will developments of mini power plants burning coal and municipal wastes, with utilization of waste heat, be attractive to communities and rural areas?

-- Can lakes or ponds associated with new energy facilities provide new recreational facilities which enhance local values?

IV. HOW WILL THE COMMONWEALTH REGULATE USE OF LAND AND WATER AND OTHER NATURAL RESOURCES?

- WILL THE COMMONWEALTH DEVELOP A LAND USE POLICY TO GUIDE NECESSARY PUBLIC AND PRIVATE DEVELOPMENTS IN A PRUDENT MANNER WHILE PROTECTING INDIVIDUAL AND COMMUNITY INTERESTS?

  -- What are the total demands on Pennsylvania's land and water use for all major developments (energy facilities, industrial plants, highways, airports, rail lines, shopping centers, motels, suburban developments, etc.) by the year 2000, and what portion of these stem from new energy facility developments?

  -- What are the special demands (size of site, water, environmental impact, etc.) of each type of development, and what special restrictions and priorities should be established in light of these?

  -- What mechanisms can be devised to assure consideration, evaluation, and selection of alternatives, in an equitable manner, with proper attention to state and local goals and policies? How do the hard decisions get made in a given instance, and how do we assure appropriate participation by the public, industry, and government?

  -- Should the state locate, designate, set aside, and/or acquire and lease or sell sites for power plants or power parks?

  -- Is state legislation on multiple utility corridors desirable?

  -- Should the Commonwealth permit higher thermal loading by energy plants of selected limited portions of certain specified streams, thereby minimizing the need for artificial lakes where the latter present significant land or water use problems?

  -- Should the Commonwealth permit reservoirs or lakes to be dedicated to power plant cooling, permitting less stringent thermal pollution limits, thereby lowering electricity costs to the consumer, but with regulations of water quality and water management to maintain protection of Pennsylvania's public waters?

V. WHAT TRADE-OFFS DO DIFFERENT TYPES AND SIZES OF POWER PLANTS OFFER IN PENNSYLVANIA?

- THERE IS A NEED FOR INITIAL AND ON-GOING ANALYSES OF THE TRADE-OFFS WHICH DIFFERENT TYPES AND SIZES OF ENERGY FACILITIES OFFER PENNSYLVANIA.

  -- What trade-offs do different types and sizes of power plants and sites offer in meeting the criteria and issues set forth above?

  -- Will air quality restrictions limit coal-fired generating plants in size and concentration? How does the acceptability of a coal-fired plant (the availability of sites) in Pennsylvania depend on its size? Will 100 MW, 2000 MW, or clusters of up to 6000 MW total capacity be acceptable?

  -- In terms of Commonwealth policy, under what conditions, where, with what safeguards, will new nuclear power plants be welcomed in Pennsylvania? Will we allow 1000 MW plants (or larger)? Will we allow (or encourage) clusters of modest size (5000 to 7000 MW)?

  -- What role can mini plants play? How much power can they supply, at what cost? Where? Will we encourage them? How?

  -- What role can pumped-storage hydroelectric plants play in meeting peak power demands? At what costs? Where?

  -- Is it preferable to develop 20 to 50 sites for power plants with cooling ponds, or a smaller number plus two or three medium-sized energy clusters with artificial lakes? What are the impacts of artificial lakes of different sizes on Pennsylvania's communities, and on land use and water management policies?

  -- Would a mixture of generating plants of different sizes and types best serve the Commonwealth's need to provide electrical power? If so, can we express guidelines for identification and development of an "optimum mix" of new power plants (and sites) of different types and sizes?

  -- If large power plants are developed in isolation, should their isolation be maintained? Why and how? Or, why not? How is isolation defined?

  -- Can waste heat from isolated power plants be utilized? Are agricultural or aquacultural applications feasible?

VI. ARE EXISTING STATE POLICY GUIDELINES, ADMINISTRATIVE MECHANISMS, AND AGENCY STRUCTURES ADEQUATE TO REGULATE ENERGY FACILITY SITING IN THE FUTURE?

- WHAT SHOULD THE POLICY GUIDELINES AND ADMINISTRATIVE MECHANISMS PROVIDE?

-- Do they provide guidelines and agency administrative responsibility for initial and on-going definition and active promotion of responsible growth, meeting the needs of Pennsylvanians for jobs, an adequate income, and a viable society?

-- Do they provide guidelines and agency administrative responsibility for initial and on-going policies, regulations, and programs to assure adequate protection of Pennsylvania's environment and public health and safety, and prudent use of the Commonwealth's land, water, energy, and other resources?

-- Are the existing policies and mechanisms sufficiently flexible and comprehensive to adapt to changes in federal and local policies and attitudes, and to economic, social, and technological changes in the foreseeable future?

-- Do the processes governing energy facility siting and other public and private developments assure a) on-going assessment of need and impacts of alternatives, b) evaluation and selection of alternatives with ample opportunity for public, industry, and government participation, c) sufficient latitude and incentive for risk-taking by developers and for acceptance by local interests, d) means for continually examining and re-examining the development goals of the Commonwealth and of its regions?

-- Finally, does the process governing energy facility siting and other developments provide a clear and effective means and authority to provide equitable and wise regulatory actions in a reasonable time and in an economical manner?

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